



TM-562
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TURNING OFF MAIN-RING LCW PUMPS

B. A. Prichard

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Currently the main-ring LCW system utilizes all 24 pumps, one located in each of the service buildings. This system supplies a differential pressure of 160 psi and a flow rate of approximately 530 GPM at each building. During normal operation the failure or shutdown of any single pump for maintenance or repair leaves the system basically unperturbed as the adjoining pumps seem to handle the increased load adequately.

The question has been raised as to the cooling provided with a large number of pumps turned off and what happens if an additional pump fails while a large number (such as 12 pumps) are already off. To answer these questions measurements were made at houses D1 to E1 under the following conditions:

- 1) all pumps on,
- 2) D2, D4 off and all others on, and
- 3) D2, D3, D4 off and all others on.

The quantities measured were the flow, return pressure, supply pressure #1 and supply pressure #2. The difference between the two supply pressure readings is that the points of measurement are separated by a check valve and a throttle valve as shown in Figure 1.

Table I shows that turning off every other pump reduces the differential pressure ΔP to 110 psi in the building with an operating pump and $\Delta P = 65$ psi in the building where a pump is off. Turning off 3 pumps consecutively to simulate a pump failure while operating with only 12 pumps results in $\Delta P = 30$ psi at each of the three locations where the pumps are off consecutively. This condition also results in cavitation problems which would require additional throttling of the bounding pumps further reducing ΔP . The differential pressure at the bounding pumps remained at 110 psi.

It was also noted during these tests that the LCW pumps experienced no apparent cavitation up to a flow of ~ 550 GPM. At 550 GPM cavitation begins to become audible and increases in intensity as the flow increases. At ~ 570 GPM the pipes begin to vibrate and above 585 GPM the vibration becomes excessive.

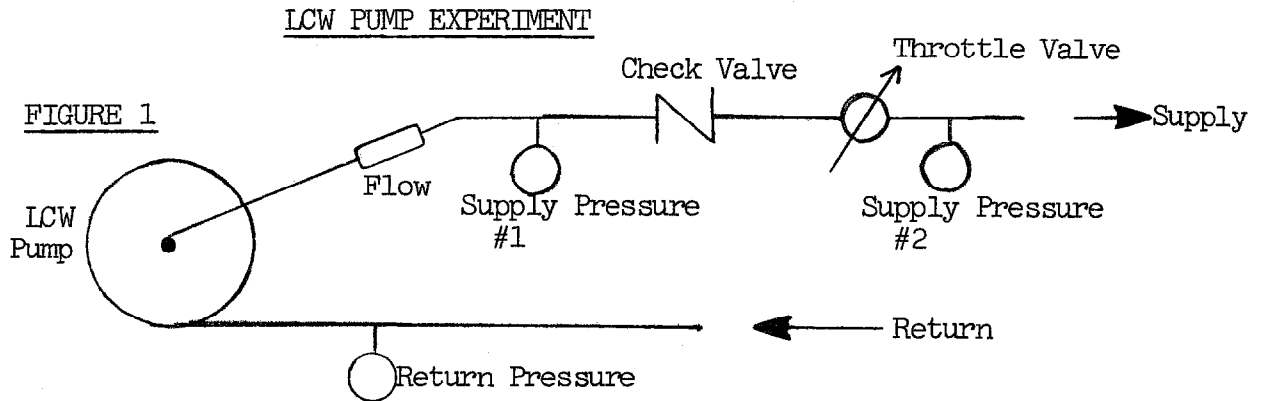


TABLE I

A) ALL PUMPS ON (Normal Operating Conditions)

	Supply #1	Supply #2	Return	Flow
D4	218 psig	180 psig	20 psig	530 GPM
D3	220 psig	195 psig	22 psig	510 GPM
D2	220 psig	180 psig	22 psig	545 GPM
D1	217 psig	180 psig	25 psig	550 GPM

B) ALL PUMPS ON (Throttled to Allow Turn Off)

	Supply #1	Supply #2	Return	Flow
D4	240 psig	180 psig	27 psig	500 GPM
D3	225 psig	195 psig	24 psig	500 GPM
D2	237 psig	175 psig	27 psig	500 GPM
D1	237 psig	180 psig	27 psig	500 GPM

C) D2 and D4 OFF (All Other Pumps On)

	Supply #1	Supply #2	Return	Flow
D1*	237	165	44	540
D2	76	140	76	none
D3*	217	160	52	585
D4	77	145	72	none
E1*	220	160	41	570

continued.....

* under Condition C):

D1 Pump - mild noise

D3 Pump - loud cavitation, moderate pipe vibration

E1 Pump - slight cavitation, no vibration

D) D2, D3, and D4 - OFF (All Other Pumps On)

	Supply #1	Supply #2	Return	Flow
D1*	235 psig	157 psig	48 psig	555 GPM
D2	98 psig	122 psig	96 psig	none
D3	106 psig	127 psig	96 psig	none
D4	101 psig	127 psig	93 psig	none
E1*	220	160	48	590 GPM

* under Condition D):

D1 Pump - slight cavitation, mild vibration

E1 Pump - loud cavitation, excessive vibration.